Water content

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by

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Preface

This guide deals with determination of water content in soil sorts.

The guide is part of a series, which explain the execution of geotechnical classification experiments as carried out at the Geotechnical Engineering Laboratory.

The guide is constructed as follows:

- *Appertaining standards*
- *Definitions*
- *Apparatus*
- *Equipment calibration*
- *Preparing the test sample*
- *Procedure for experiment*
- *Calculation*
- *Reporting*
- *Remarks*
- *Schema for experiment execution*
- *Appendix, if any*

It is recommended that the user of this guide reads the entire guide before the experiment is started.

Numbering of figures in the text is indicated by { }.

Units are indicated by [ ], e.g. [%].

Appertaining standard

The experiment is based on and further described in the standard DS/CEN ISO/TS 17892-1

Definition

The water content, w, is defined as the weight loss of the soil in [%] of the dry weight by drying in an incubator at a temperature of 105^{o} C to a constant weight.

Equation 1: Water content.

$$w = \frac{W_w}{W_s} \cdot 100\%$$

W_s is the weight of the dried sample [g]
W_w is the weight of the water in the sample [g]

The water content for naturally occurring soil types can be around zero and several hundred per cent. The largest water content is found in organic soil sorts as peat and gyttja.

The water content is usually determined with the standard method (drying-weighing method). With determining water content in sand, the carbide method can also be used.

Apparatus

- Scale, weighing accuracy 0.01 g
- Bowl in heat and corrosion resistant material, figure 1.
- Oven, temperature up to 105^{o} C {1}
- Vacuum desiccator {2}

Figure 1: Different bowls applicable for water content experiment.

Figure 2: Oven and vacuum desiccator.

Equipment calibration

The equipment does not need to be calibrated before the experiment. The temperature in the oven as well as the weighing accuracy of the scale must be checked annually.

Preparing the test sample

The size of the subsample depends on the soil type and of the amount of soil available. Minimum amount that can be applied is seen in

table 1. If smaller amounts are used, this must be noted in the reporting.

Table 1: Smallest sample amount for determining water content.

Particle diameter, D_{90} Mm	Minimum amount of moist sample g
1.0	25
2.0	100
4.0	300
16.0	500
31.5	1500
63.0	5000

In general, it is sufficient to demand a weighing accuracy of 0.1 % of the weight of the soil sample. A soil sample of 10 g must, therefore, be weighed with an accuracy of 0.01 g.

Procedure for experiment

The following procedure is used:

- A clean and dry bowl is weighed, and the weight is noted, $bowl$.
- An appropriate amount of soil, cf. table 1, is placed in the bowl, figure 3, and everything is weighed directly, $W+bowl$.
- The bowl is put in the oven at 105^{o} C, and dried until steady weight is achieved. This is normally achieved with drying for minimum 24 hours.
- After drying to a constant weight, the bowl is put aside for cooling in the vacuum desiccator until room temperature is achieved.
- The cooled bowl with the dry soil sample is weighed, W_s+bowl.

Figure 3: Clay samples before and after drying for 24 hours at 105°C.

Calculations

Water content w [%] is calculated cf.

equation 1:

$$w = \frac{W_w}{W_s} \cdot 100\% = \frac{(W + bowl) - (W_s + bowl)}{(W_s + bowl) - bowl} \cdot 100\%$$

Reporting

The water content is indicated by 1 decimal.

If less material is used than stated in table 1, the applied sample amount is noted.

Remarks

Generally, the larger the subsample is, the more accurate the determination will be.

With large sample amounts and very heavy clay, the sample must also be checked to see if it is completely dry in the middle.

A constant weight means that the weight of the sample does not change more than 0.1% from the original weight of the sample with an additional 4 hours of drying.

The drying time depends, among other things, on the sample amount. Very large and wet samples as well as samples of heavy clay types can take more than one day to dry.

If wet samples are put in the oven with samples that are almost dry, these must stay a while longer as they can absorb some of the moisture from the wet samples. Therefore, avoid putting wet samples in the drying oven if there are dry samples in there already.

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Water content

Case			Case no.
Examined	to	Lab. no.	Boring no.
Controlled d.	Approved d.	Level	Appendix no.

WATER CONTENT

Sample	no					
Bowl	no					
Bowl in drying cab.	dd h.					
Bowl out drying cab.	dd h.					
Bowl + W	g					
Bowl + W_s	g					
Bowl	g					
W_w	g					
W_s	g					
$w\% = \frac{W_w}{W_s} \cdot 100$	%					

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